

Includes—

Complete details on a small farm tractor which may be built from old automobile parts at small cost, and also plans for a garden tractor powered with a single-cylinder motor-cycle engine.

HOW TO BUILD YOUR OWN FARM *&c* GARDEN TRACTOR

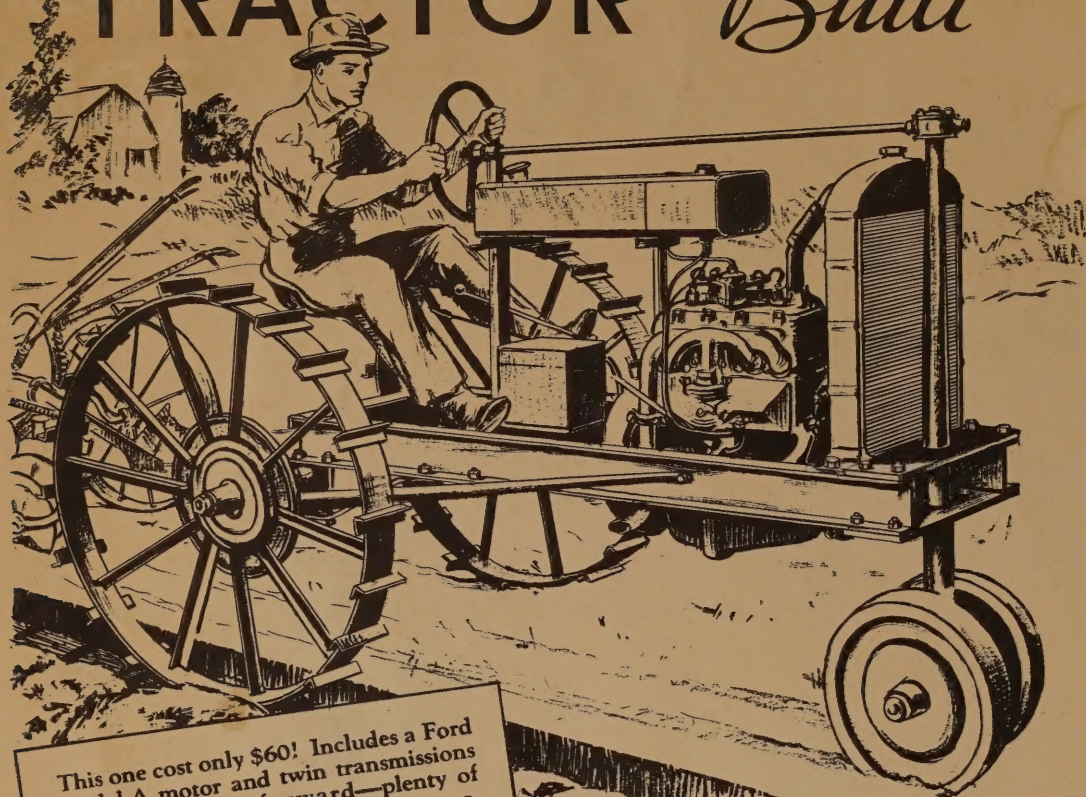


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TRACTOR *Built*



This one cost only \$60! Includes a Ford model-A motor and twin transmissions giving six speeds forward—plenty of power to pull a two-bottom plow, a two-row cultivator and other implements. Wrenches, hacksaw and drill are about the only tools needed—except some welding at your local machine shop

By H. SUDDABY

Frame, Motor, Steering Gear and Driving Mechanism

HERE is power and plenty of it for truck gardeners or owners of small farms who want a dependable tractor at low cost. Its high wheels and wide tread make this tractor ideal for modern row-crop tillage. Under average soil conditions, it will handle a two-bottom 12-in. plow, a 6 or 7-ft. tandem disk harrow, and with a little altering, some two-row cultivators can be adapted to use with it. In some cases, wheel weights will add considerably to the tractive effort under heavy pulls. Anyone can build the tractor as it consists of old

car and truck parts so ingeniously selected that the assembling can be done with wrenches, a hack saw and a little welding, the latter being done for a few dollars by your local machine shop.

Begin construction with the steering assembly, which is detailed in Figs. 1 to 5. For this you will need one Chevrolet steering column complete, one differential housing, two axles, two front spindles complete with wheels, and one model-T Ford truck drive-shaft housing. First cut off one end of the differential housing at the spring saddle 4 in. from the brake assembly. Remove the rivets that hold the brake flange. Next cut off the end of the drive-shaft housing $4\frac{1}{2}$ in. from the universal casting, removing enough from the other end of the housing to make it $37\frac{1}{2}$ in. long. Now weld the short piece of differential housing to the drive-shaft housing as in Fig. 3. Notice that the rear-axle bearing is used to

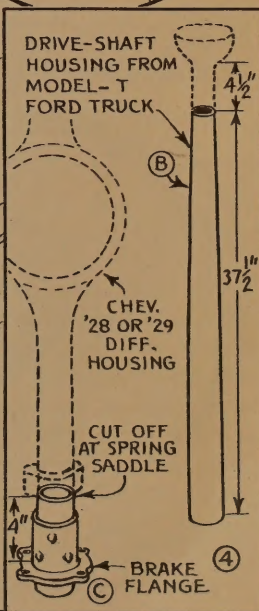
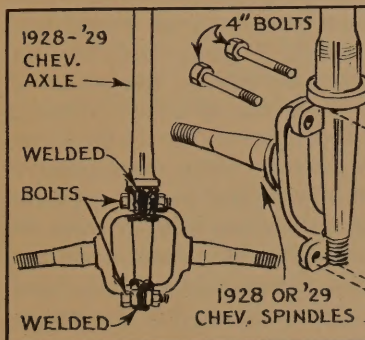
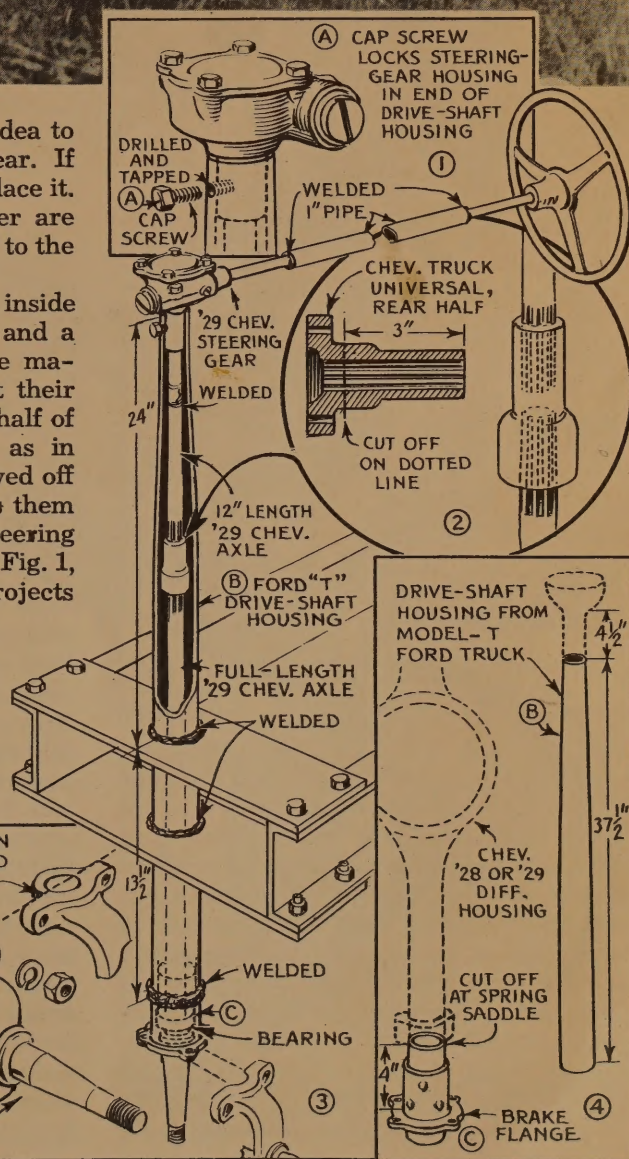
from Old Car Parts

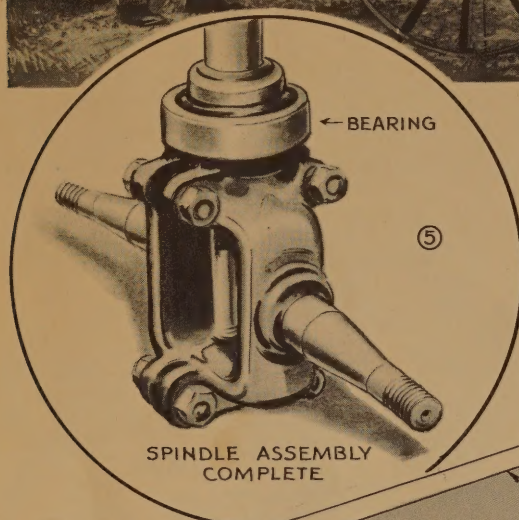
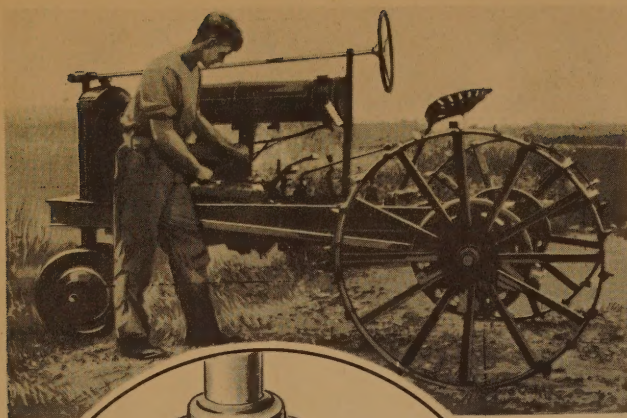
WITHOUT MACHINING



support the front end. It is a good idea to examine this bearing closely for wear. If undue wear shows, it will pay to replace it. The dust plate and grease container are cut in half so that they can be bolted to the axle after it has been inserted.

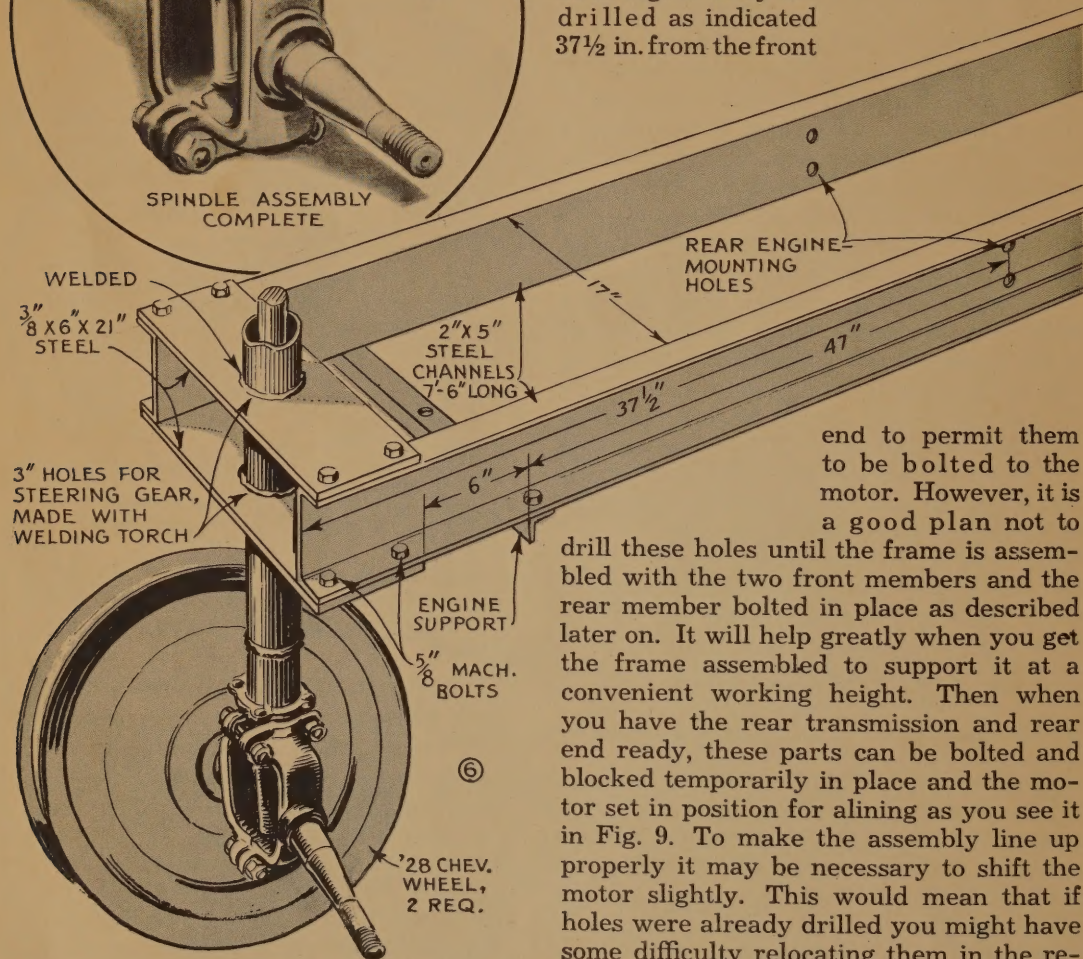
Then assemble the Chevrolet axles inside the housing, using one full length and a 12-in. length of the other. To save machining the shafts, you can connect their splined ends together with the rear half of a Chevrolet truck universal joint as in Fig. 2. The shoulder or flange is sawed off to leave a splined sleeve, which ties them together without play. Mount the steering column on top of the assembly as in Fig. 1, and weld the end of the shaft that projects from the gear housing to the axle end. You will have to drill and tap the upper end of the drive-shaft housing for a cap screw to keep the column in position. The steering-wheel shaft will have to





be cut in the center and a 4-ft. length of $\frac{3}{4}$ -in. pipe slipped over the ends and welded to lengthen the shaft so that it will reach back to the operator's seat. Next comes the wheel spindles, which are bolted and welded to the tapered lower end of the steering assembly after cutting the bosses off the spindles as shown in Fig. 3. Care must be taken with this assembly to make sure that both spindles are tilted to the same angle as indicated. In the vertical plane the spindles should aline exactly, otherwise, the front wheels would toe in or out, making the tractor difficult to steer.

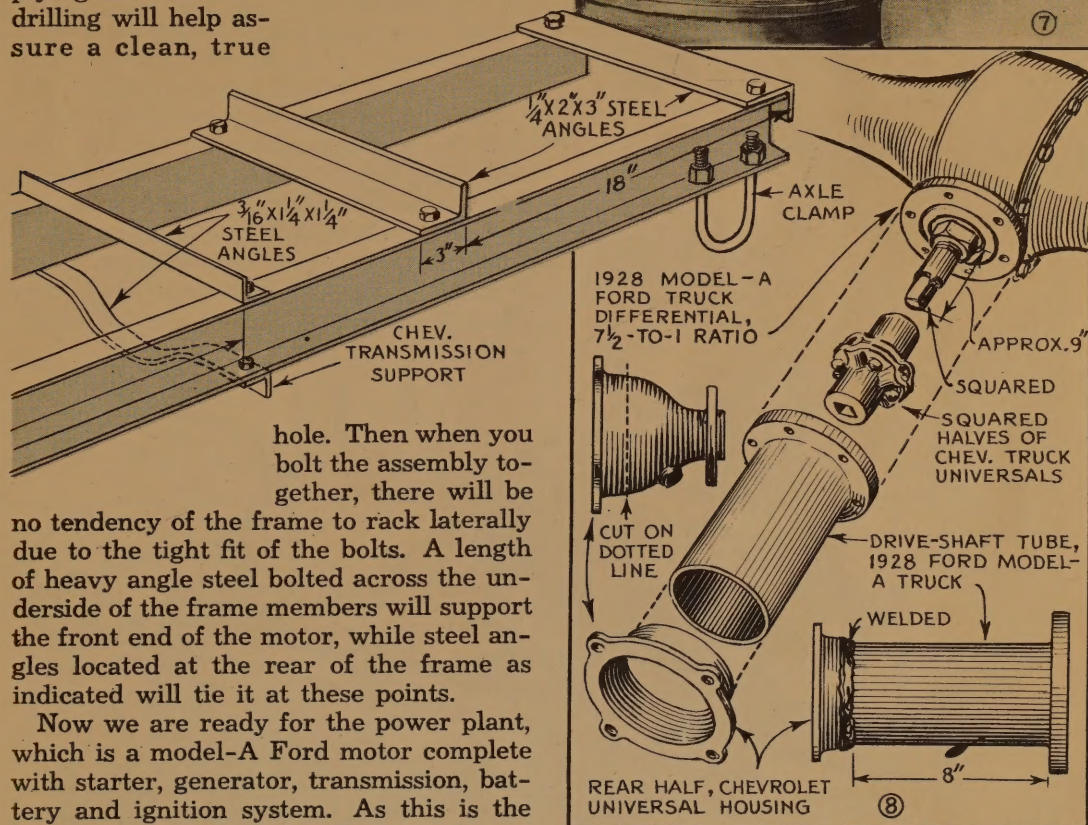
Now you are ready for the frame. The side members are made from channel steel as in Fig. 6. They are drilled as indicated $37\frac{1}{2}$ in. from the front



FASTENING SPINDLE ASSEMBLIES TO TAPERED END OF AXLE SHAFT TILTS WHEELS AT JUST THE RIGHT ANGLE FOR EASY STEERING

end to permit them to be bolted to the motor. However, it is a good plan not to drill these holes until the frame is assembled with the two front members and the rear member bolted in place as described later on. It will help greatly when you get the frame assembled to support it at a convenient working height. Then when you have the rear transmission and rear end ready, these parts can be bolted and blocked temporarily in place and the motor set in position for alining as you see it in Fig. 9. To make the assembly line up properly it may be necessary to shift the motor slightly. This would mean that if holes were already drilled you might have some difficulty relocating them in the required position. The two cross members that support the front-end assembly have 3-in. holes drilled or burned in the center

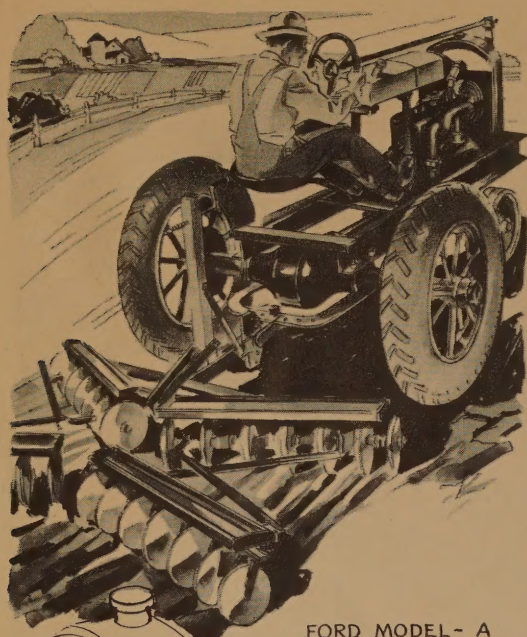
with a welding torch to allow the steering column to be inserted and welded as shown in Fig. 3. These members must be welded 5 in. apart to allow them to be slipped over the ends of the frame members and fastened with $\frac{5}{8}$ -in. bolts, the top front member being located 24 in. from the top of the drive shaft. As the front of the frame is subjected to rather severe twisting strains, it is best to drill the holes with a $\frac{5}{8}$ -in. drill bit, using each cross member as a jig so that the holes register perfectly. Applying lard oil while drilling will help assure a clean, true



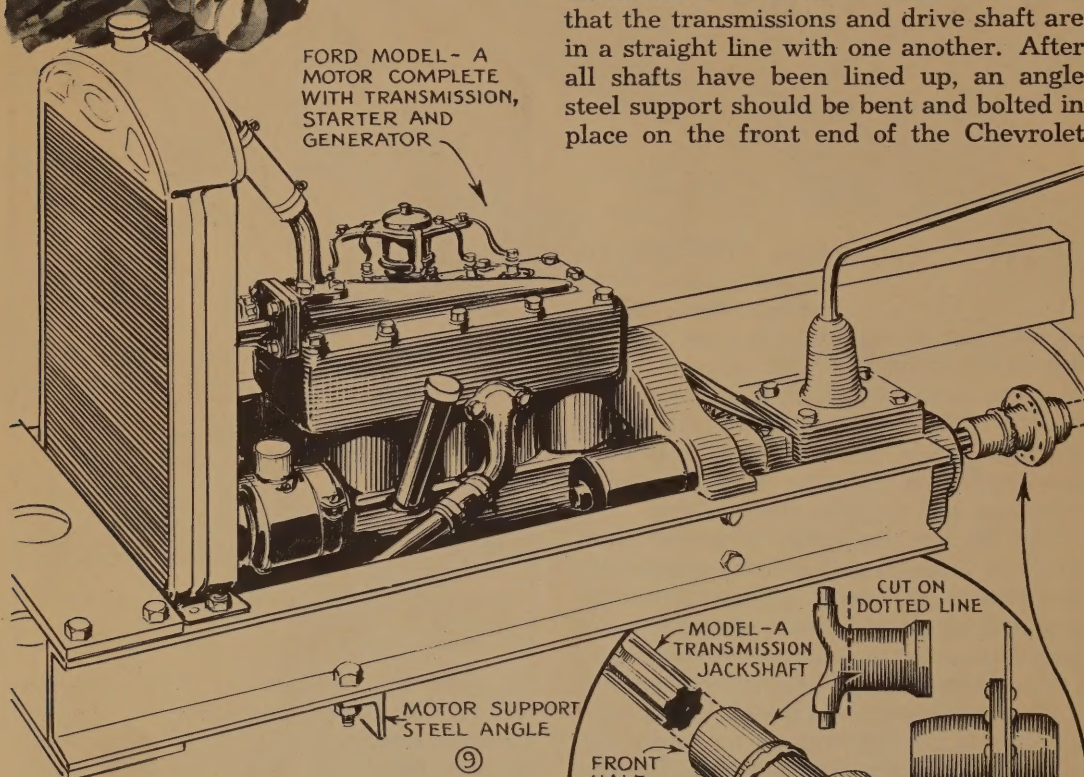
hole. Then when you bolt the assembly together, there will be no tendency of the frame to rack laterally due to the tight fit of the bolts. A length of heavy angle steel bolted across the underside of the frame members will support the front end of the motor, while steel angles located at the rear of the frame as indicated will tie it at these points.

Now we are ready for the power plant, which is a model-A Ford motor complete with starter, generator, transmission, battery and ignition system. As this is the heart of the tractor, it must be in good condition. If the motor has seen considerable service, it should be reconditioned completely and any worn parts replaced. The same goes for the transmission. Remove the cover, wash out all old grease with gasoline and inspect the gears and bearings for excessive wear. If some are worn badly, replacement at this time may avoid breakdowns later. Assemble the transmission and fill it with fresh lubricant. Now mount the motor assembly temporarily in position in the frame. Then get a four-speed Chevrolet truck transmission and a model-A Ford truck differential

assembly to complete the driving mechanism. Clean them thoroughly and inspect for wear, replacing any parts that seem to be worn badly. If this is not done, additional wear will be rapid due to continuous strain on these parts when the tractor is pulling a load. To connect the transmission and differential, carefully square the stub shaft of the latter with a file to take the square opening of a connector made by bolting the rear halves of two Chevrolet-truck universal joints together as in Fig. 8. Then cut off the model-A Ford drive-shaft tube that came with the



FORD MODEL-A
MOTOR COMPLETE
WITH TRANSMISSION,
STARTER AND
GENERATOR

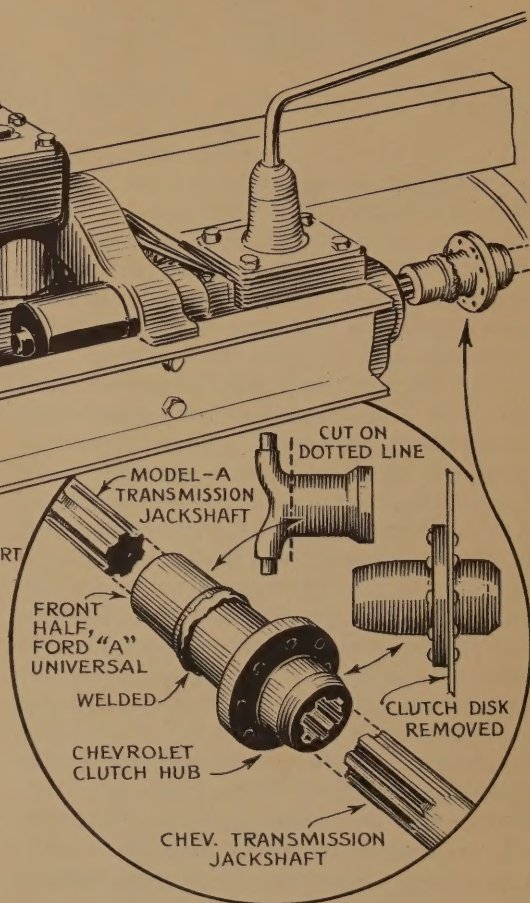


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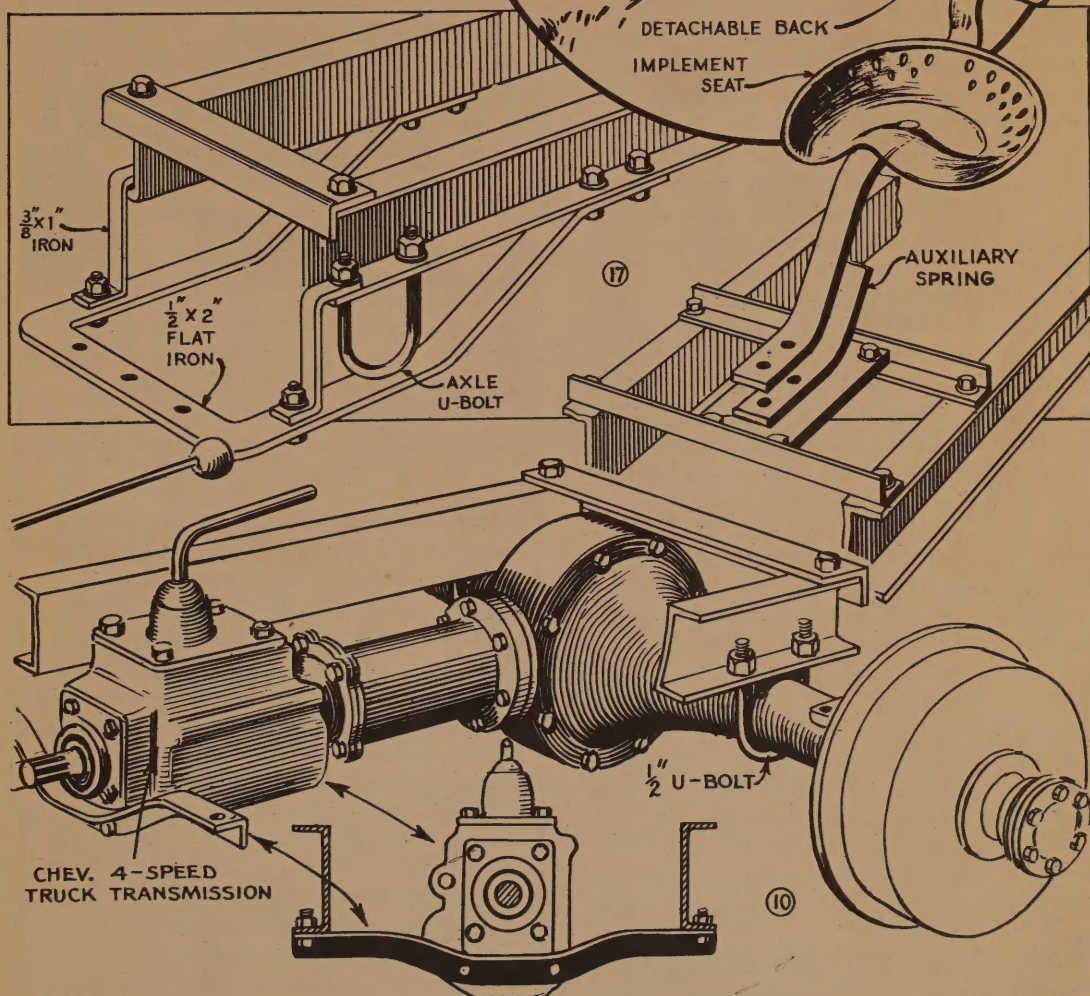
truck differential 8 in. from the flange at the rear end and weld the rear half of a Chevrolet universal-joint housing to the severed end as in Fig. 7, first cutting off the rear end of the universal housing as indicated in Fig. 8. This allows you to bolt the transmission and differential rigidly together as shown in Figs. 9 and 10. Now set this assembly temporarily under the

rear end of the frame. A connector to fasten the stub shafts of the two transmissions together and complete the driving mechanism is shown in the circular detail of Fig. 9. This consists of a Chevrolet clutch hub, with the clutch disk removed, welded to the front half of a model-A Ford universal joint, which has been sawed off as indicated by the dotted lines. This gives you a strong connector that will slip over the splined ends of the two transmission shafts of different diameters without expensive machining in having a sleeve made for this purpose.

Now you are ready to align the motor, transmissions and differential and bolt them in their respective positions in the frame. This must be done perfectly, otherwise the bearings will wear rapidly. The motor has to be tilted down in the rear so that the transmissions and drive shaft are in a straight line with one another. After all shafts have been lined up, an angle steel support should be bent and bolted in place on the front end of the Chevrolet



transmission, holding it rigidly to the frame. Several short bolts must be screwed into the holes in the front end of this transmission, that formerly held the clutch housing to the transmission, to prevent the gear oil from leaking out. However, two of the bolts are used to hold the support previously mentioned. Next, the front motor support may have to be bent up or down to aline the transmissions with one another. If the two are in alinement, the jack shaft at the rear end of the Chevrolet



transmission can be turned freely with the hand if both transmissions are in neutral.

After this work has been done, bolt the rear end assembly to the Chevrolet transmission and fasten the axle housing rigidly

to the frame with heavy U-bolts. Be sure, before you draw up the bolts between the transmission and rear end, that meeting surfaces are entirely free from hardened grease or accumulations of dirt. Use lock-

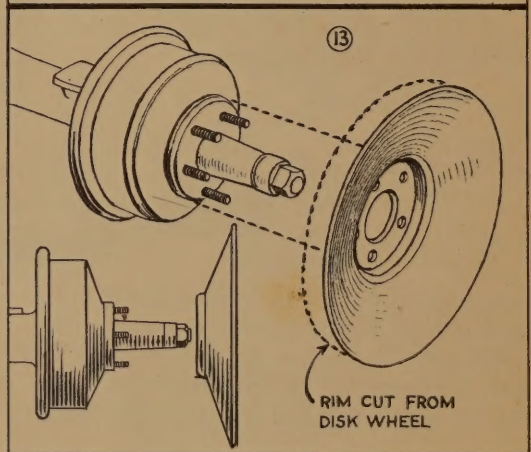
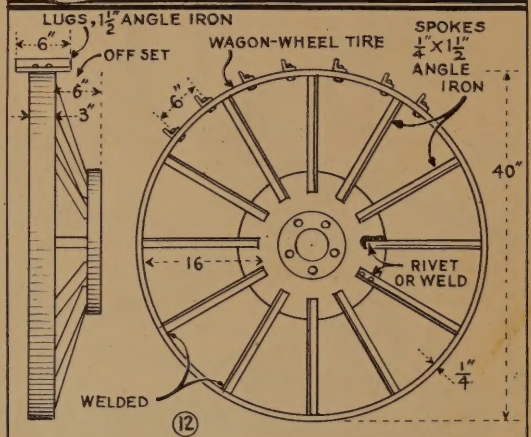
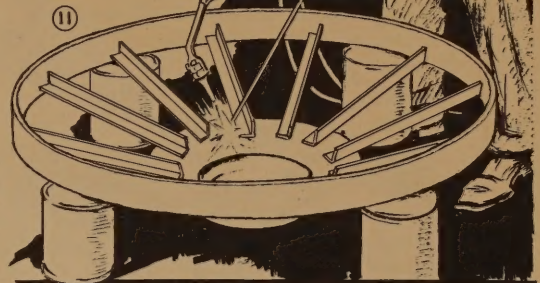
Finishing the FARM TRACTOR

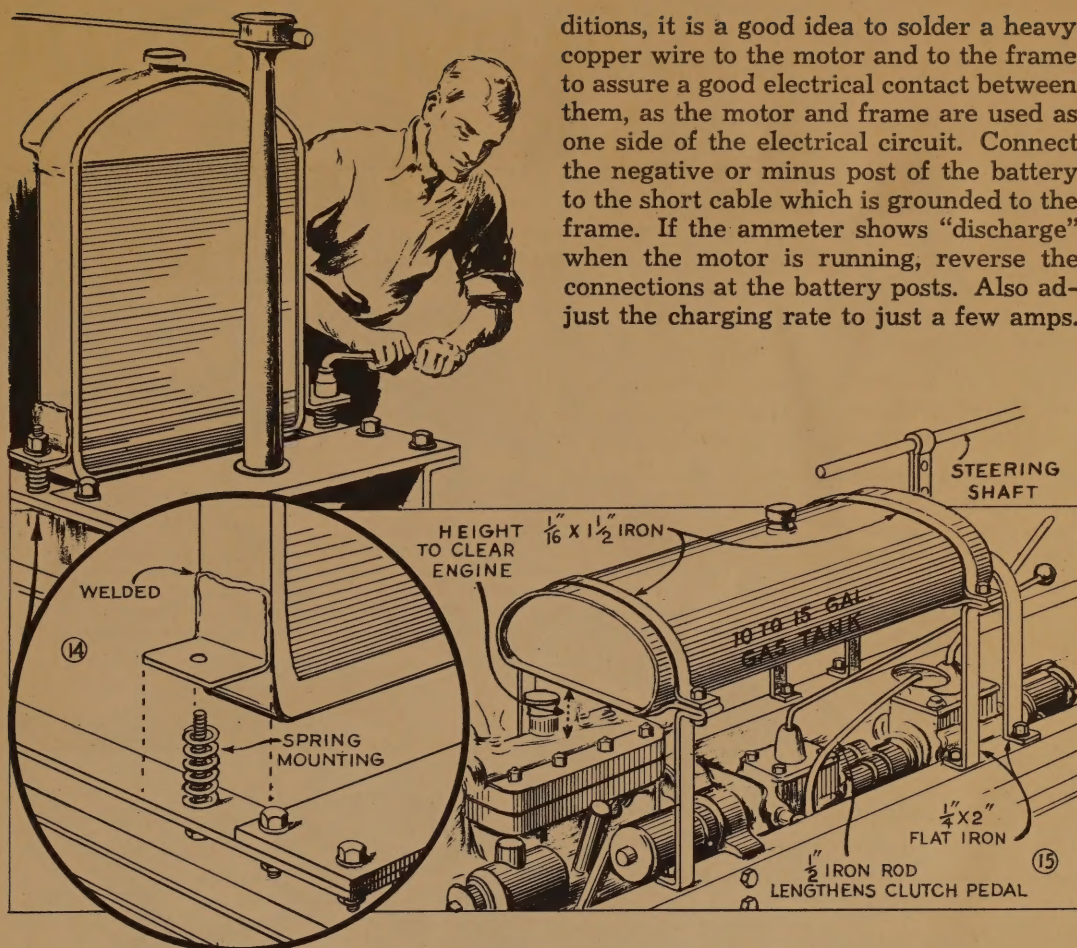


washers under all nuts and cap screws and draw them up evenly to avoid stripping threads. See that the driving assembly is not thrown out of alinement in doing this. It is a good idea to tack-weld the U-bolts to the axle housing after perfect alinement has been assured. You are now ready for the wheels, seat, drawbar, etc.

After finishing the tractor frame and installing the motor, driving mechanism and rear end, you are ready for the wheels. Each rear wheel consists of a wagon-wheel tire 40 in. in diameter and 3 in. wide, twelve angle-iron spokes 16 in. long, and the disk wheel that came with the truck rear end as shown in Fig. 12. First cut off the rim of the truck wheel as in Fig. 13 and place it level on a floor. Next place the wagon tire over the wheel and support it 6 in. above the wheel. Space the spokes equi-distant around the wheel and tire and weld them in place as in Fig. 11. If desired, you can hot-rivet the spokes to the wheel, and if possible electric weld them to the tire as this gives a stronger joint than a welding torch. Now drill the tire and bolt angle-iron or steel lugs to it 6 in. apart. If the work has been done carefully, you now have a wheel with a 6-in. dish that is strong enough to withstand the pulling strain of the tractor. If you care to go to the added expense you can use rubber tires instead of the steel rims. If this is done, cut the spokes to suit the rims and assemble the wheel in the same way.

Next comes the fuel tank. As the model-A motor has an updraft carburetor with a gravity feed, the tank must be elevated above the motor in a manner similar to that shown in Figs. 15 and 16. Install the radiator so that you can have the regular hose connections, using the original spring-type mounting as in Fig. 14. Install the





original model-A ignition system complete with generator and starter. Make up a wood instrument panel for the ammeter and switch and mount it at the rear of the gas tank. Bolt the coil to the front end of the gas-tank support and run a wire from one terminal of the coil to the ignition switch. Connect the other terminal of the coil with the starter button. The wire from the generator to the starter completes the primary circuit. A wire from the center of the coil to the distributor cap completes the high-tension circuit. The throttle and choke are operated with dash-type controls, and should be placed close at hand. In fact, all of the controls are on the right-hand side of the steering-post support.

Any good 6-volt storage battery will do for the tractor, and you can use the original Ford battery cables, grounding the short one to the tractor frame and running the longer one to the starter terminal. As the tractor is operated under dusty con-

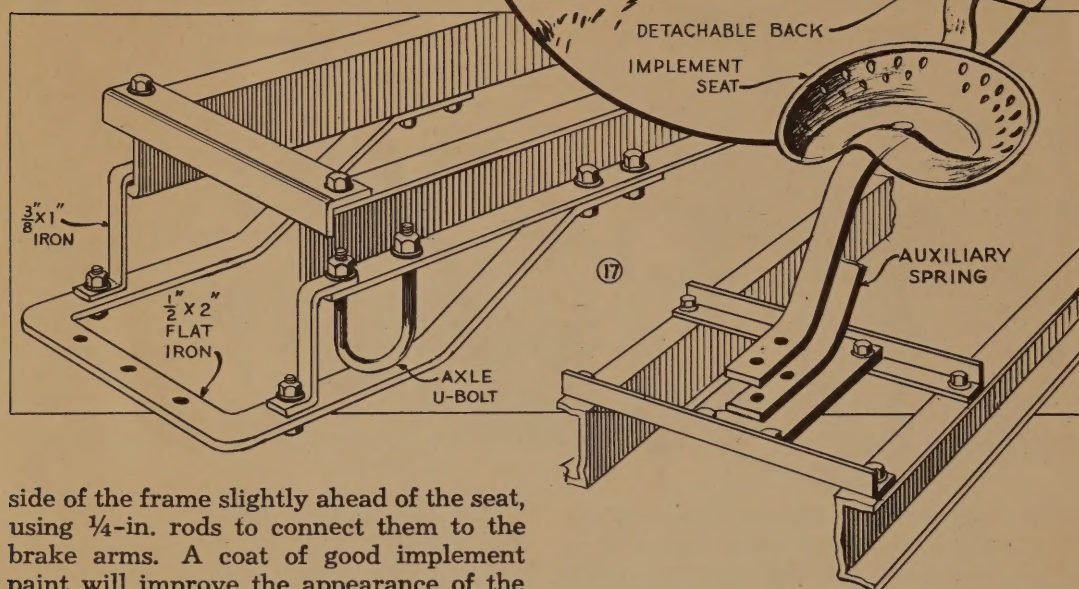
ditions, it is a good idea to solder a heavy copper wire to the motor and to the frame to assure a good electrical contact between them, as the motor and frame are used as one side of the electrical circuit. Connect the negative or minus post of the battery to the short cable which is grounded to the frame. If the ammeter shows "discharge" when the motor is running, reverse the connections at the battery posts. Also adjust the charging rate to just a few amps.

Check the battery frequently to avoid overcharging. The starter switch is attached to the starter housing so you will have to run a small iron rod from it to within easy reach of the seat so that the motor can be started from this point.

The seat should be mounted so that it will support several times the normal weight of the driver. This is important as serious accidents can result if the seat breaks while the tractor is pulling an implement such as a disk harrow. Fig. 17 shows a way of mounting an ordinary implement seat to give ample strength. A spring back like that shown adds both comfort and safety for it will help to prevent the driver being thrown from the seat when running over rough ground. Bolt the seat to the frame a suitable distance from the steering wheel as in Fig. 17, using lock washers under the nuts. It is a good idea to use lock washers under all nuts throughout the tractor as the shocks received in

this type of work have a tendency to loosen them. The method of attaching a simple drawbar is shown in Fig. 17.

The rest of the job consists of finishing touches. You may question the fact that standard Chevrolet disk wheels are used on the front without additional rims but this was found entirely satisfactory in actual use. You can add individual brakes on each rear wheel which will help in turning while pulling heavy loads. This can be accomplished by bolting two 1-in. flat-iron handles on each



side of the frame slightly ahead of the seat, using $\frac{1}{4}$ -in. rods to connect them to the brake arms. A coat of good implement paint will improve the appearance of the finished machine. The first time you run the tractor it may be a little puzzling because of the two gear shift-levers. The first thing to do is to place both of them in low gear and use the Ford transmission

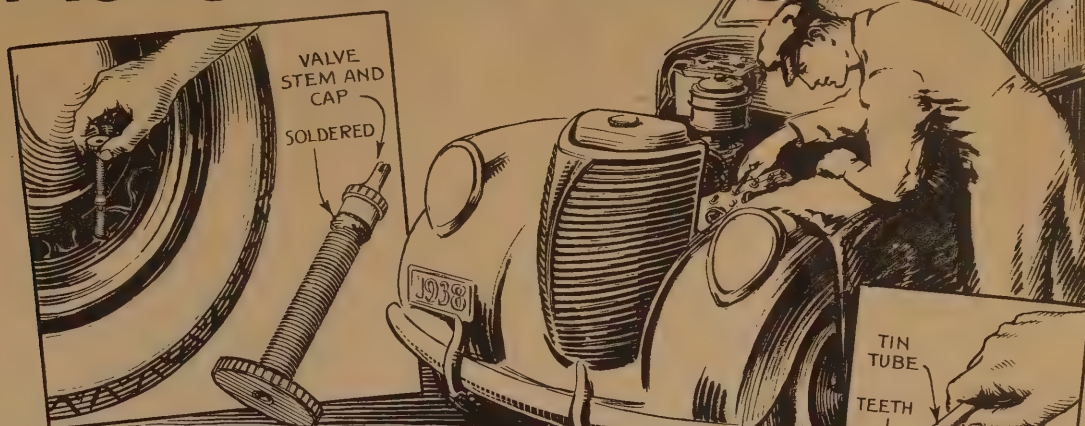
for higher speed if necessary. When you have completed this machine, you will find that it has plenty of power and that its turning ability and usefulness are far superior to most tractors built from car parts.

Welding Temperature of Aluminum Shown by Sawdust

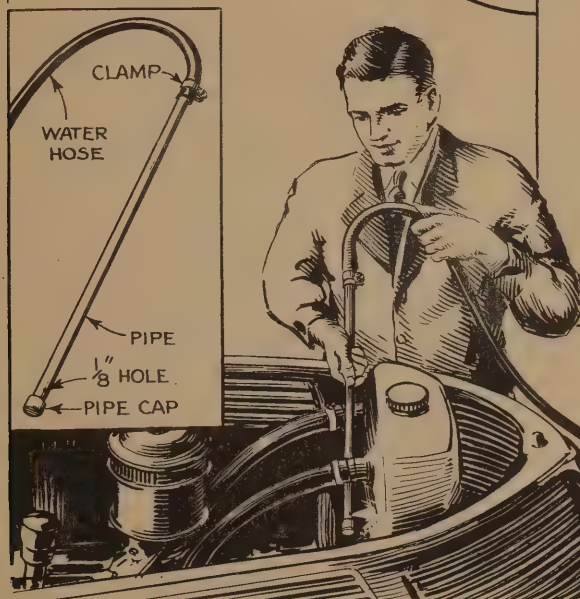
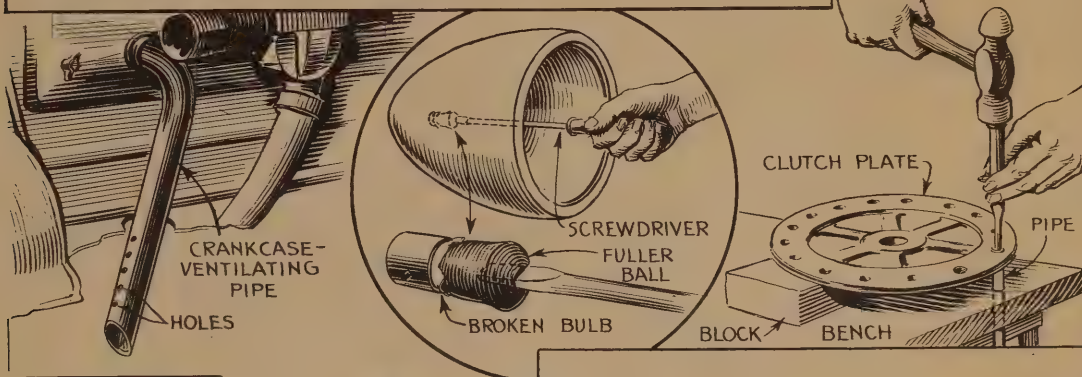
When aluminum is to be welded, preheating of the metal should not exceed 850 degrees Fahr. While experienced workers can judge when the correct temperature is being approached by tapping with a rod, or by visual inspection, beginners can determine approximate temperature by using thoroughly dry, fine, hardwood sawdust. This is sprinkled uniformly on the metal with a corn popper or flour sifter. The degree of charring of the sawdust

when applied to the metal not only shows when the right temperature is reached, but also indicates the uniformity of preheating. If the sawdust is partly charred promptly after it touches the hot metal, the temperature is sufficiently high. Sawdust containing any appreciable degree of moisture will resist charring to a greater extent than thoroughly dry sawdust, and for this reason it should be stored in a very dry place.—John E. Hyler, Peoria, Ill.

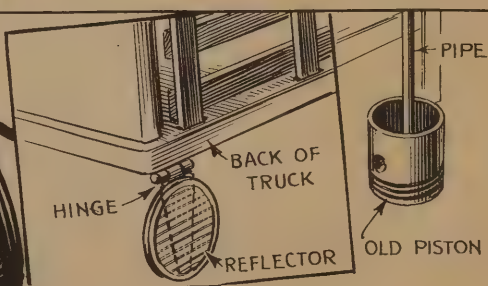
AUTO SHORTCUTS



Right, aluminum heads "frozen" to studs removed easily by first cutting away corrosion around the studs with tin tube, which has sharp teeth filed on one end. Valve stem with cap soldered on, as above, removes valve cores quickly. Small holes drilled in crankcase ventilating tube often help in cases of excessive oil consumption that hasn't been reduced by reconditioning the motor



Center, fuller ball on screwdriver removes broken bulbs safely. Above, rivets driven from clutch and brake linings fall through pipe "anvil" into receptacle on floor so that they aren't scattered about. Left, mud and insects forced from radiator fins with special water nozzle, which consists of small pipe having a cap and a small hole drilled near the capped end. Below, breakage of truck-body reflectors avoided by hinging them in place so that they swing and tend to absorb the shock if struck by some object

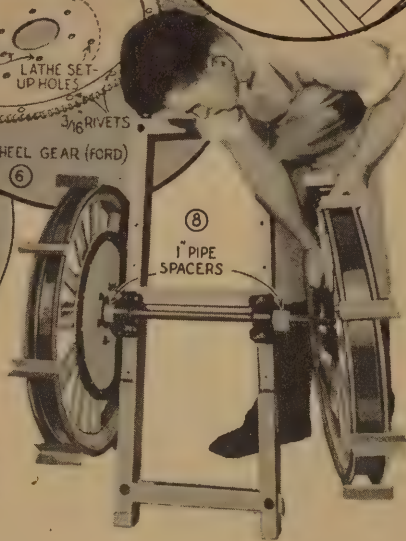
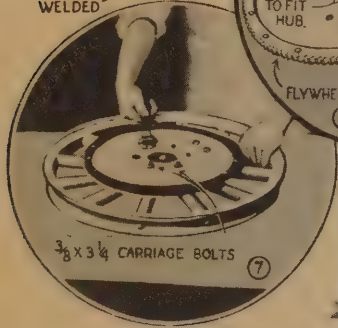
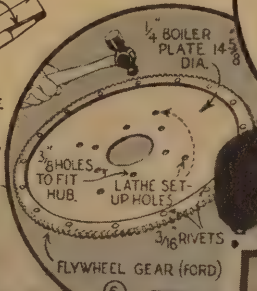
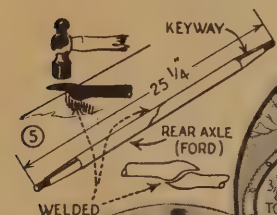
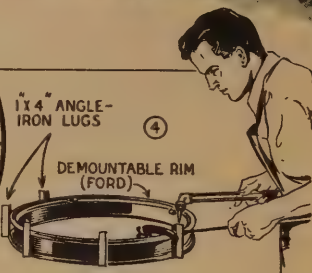
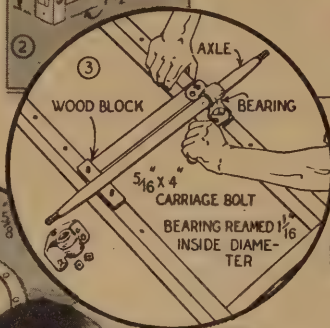
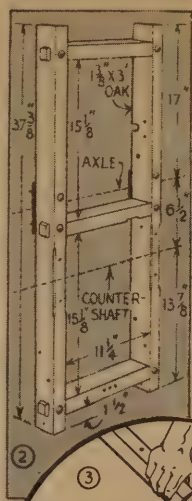




BUILD THIS SIMPLE

POWERED with a single-cylinder motorcycle engine or any motor of 2 or 3 hp., this tractor is ideal for the small truck garden. Built as shown, it is essentially a cultivator, but other units can readily be added to meet existing conditions.

Start by making the wooden frame, as shown in Fig. 2, fitting the axle to the underside by means of two bearings or spring-shackle brackets drilled to a neat fit. The axle itself is a standard Ford rear axle, welded to measure $25\frac{1}{4}$ in. long, as shown in Fig. 5. You will need a Ford flywheel gear, which is to be riveted to a disk of $\frac{1}{4}$ -in. boiler plate, inserting the rivets through the original ring-gear holes, as in Fig. 6. The plate, in turn, is bolted to a Ford rear wheel, again locating the fastenings to match the original holes, as in Fig. 7. The wheel rims should be of the demountable type, each being fitted with eight metal cleats welded into place equidistantly around the circumference, as in Fig. 4. Fig. 8 pictures the first step of the as-

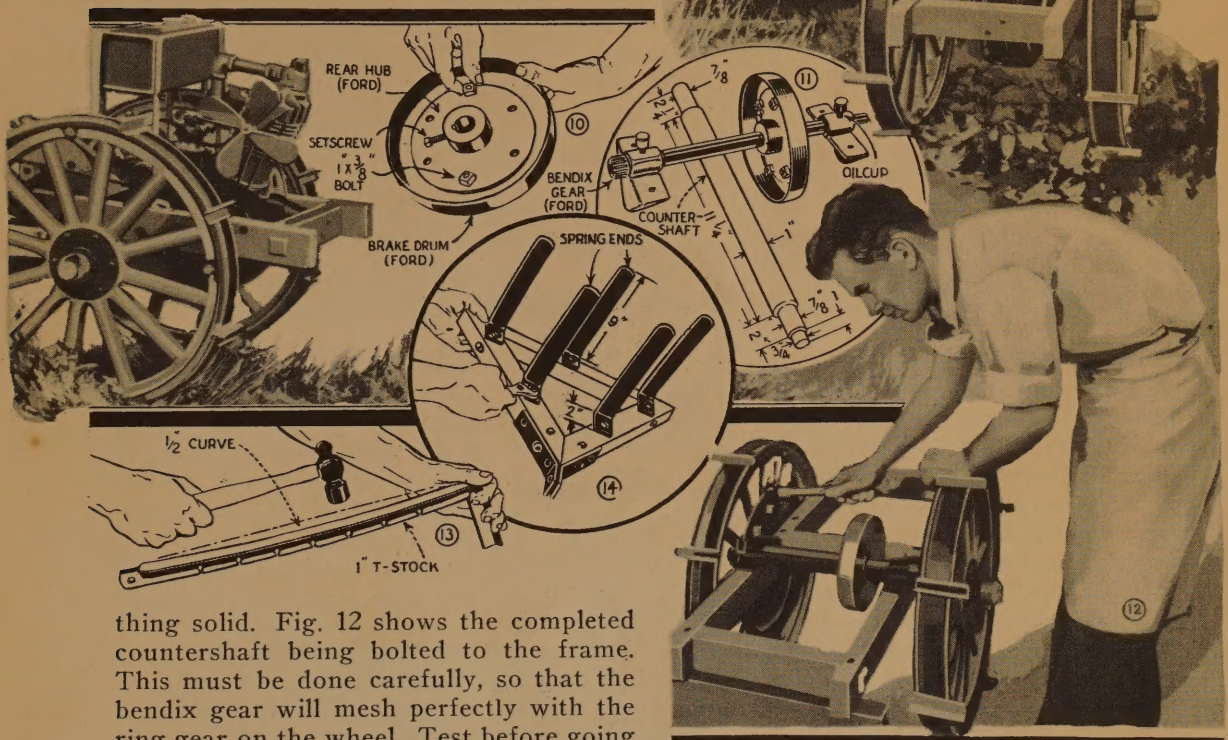


sembly. The two wheels, minus the brake drums, are fitted and keyed to the Ford axle as in the original, 1-in. pipe sections, 1 in. long, being used for spreaders, as indicated in the photograph. The next thing is the countershaft. This is turned from a Ford drive-shaft, to the dimensions given in Fig. 11. The end of the shaft, which is to take the Ford bendix gear, must be turned just a trifle oversize, so that the gear can be heated

Ford Parts and a Motorcycle Engine Are Used in Making This Simple Garden Tractor; the Manner of Fitting the Axle and Wheels to the Frame Is Shown Above

GARDEN TRACTOR..

and shrunk on. Because of the greater speed of the countershaft, it is advisable to fit grease cups on the bearings. A suitable size can be obtained from the Ford driveshaft and tapped into place. The countershaft pulley is made up according to Fig. 10, using a Ford rear hub and a Ford brake drum. Bore the hub so that it will fit tightly over the countershaft and tap for a setscrew in order to make every-

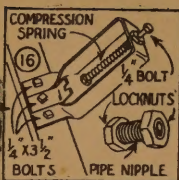
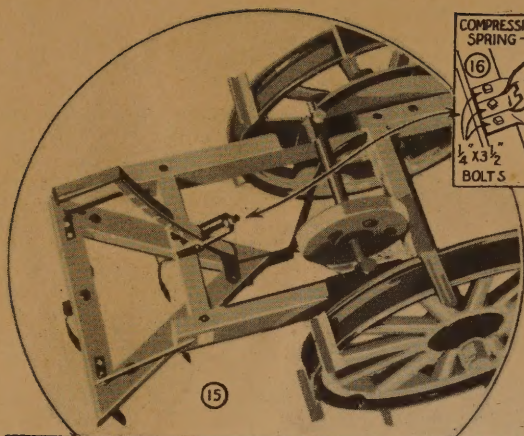


thing solid. Fig. 12 shows the completed countershaft being bolted to the frame. This must be done carefully, so that the bendix gear will mesh perfectly with the ring gear on the wheel. Test before going further by pushing the partly finished tractor backward and forward across the floor.

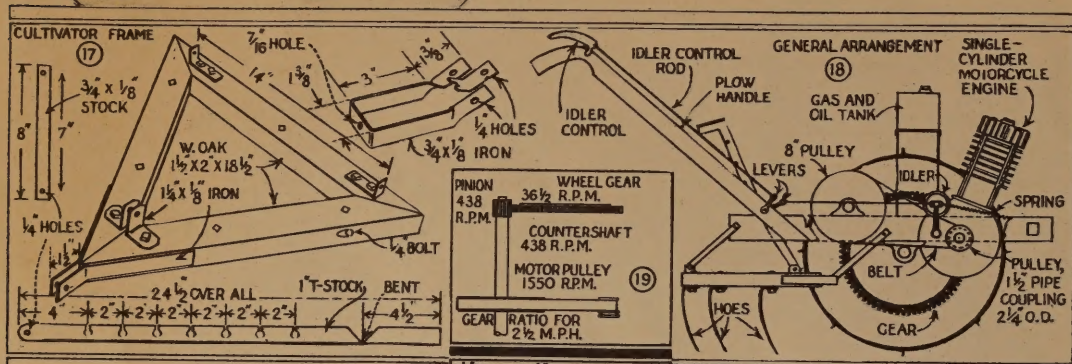
The cultivator selected is a five-tooth arrangement, intended principally for work between rows. The general details of the construction are given in Figs. 15, 16 and 17. The control arms, which regulate the depth of the cut, must be slightly curved, as in Fig. 13, in order to slide freely. The teeth are simply spring ends, cut to fit and turned over at right angles to allow bolting, as in Fig. 14. In fastening, locate the holes

forward so that each hoe will have a tendency to drag straight back when the tractor is in use. One important point here: You will notice that the cultivator is supported by two strap-iron arms at the rear and by a V-shaped hanger at the front. Be sure that these are parallel, as can be seen in Fig. 18. Otherwise, either the front or rear steels will dig in at various depths.

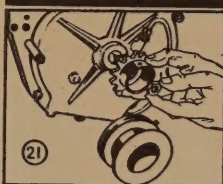
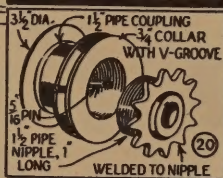
Now we come to the motor. You can get fairly good results from a $\frac{3}{4}$ -hp. motor although one of 2 or 3 hp. is prefer-



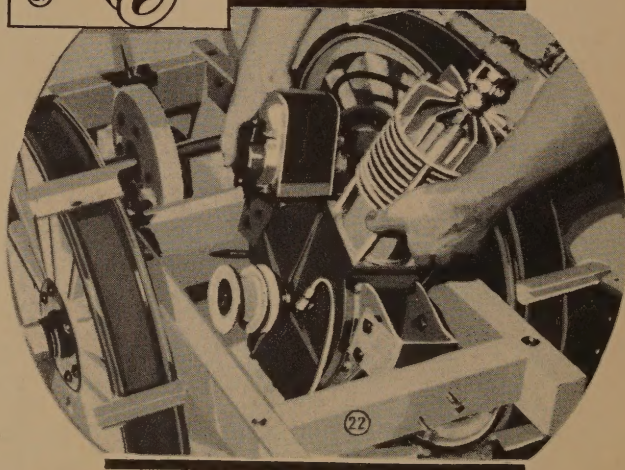
motor is mounted. Various engines will differ here, but in any case the metal support brackets should offer no difficulties. As there is no clutch on this tractor, it is evident that control must be through an idler pulley, which, when released, will let the motor run without transferring the energy to the wheels. This part of the unit is made from a Ford fan pulley, as shown in Fig. 24, and the mounting is by means of the original Ford fan bracket, as shown in Fig. 25. The control rod runs back to an L-shaped lever,



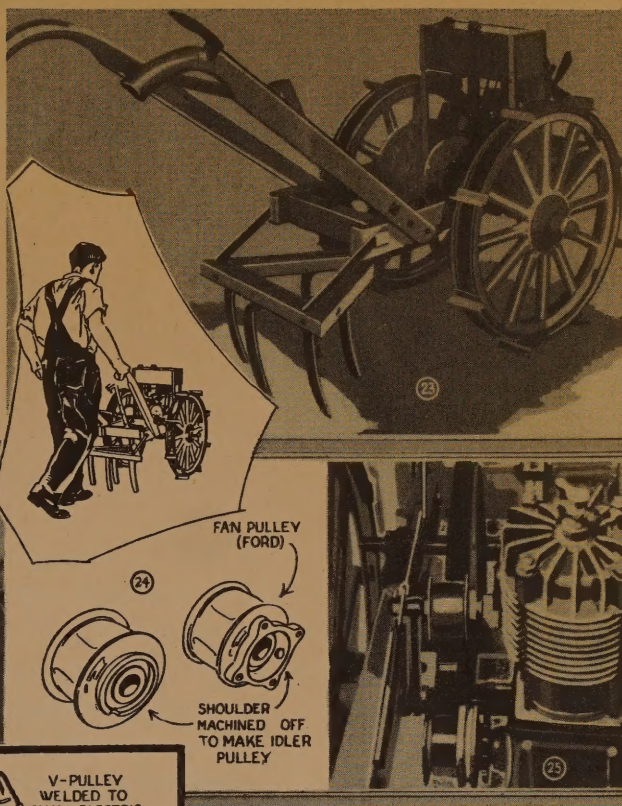
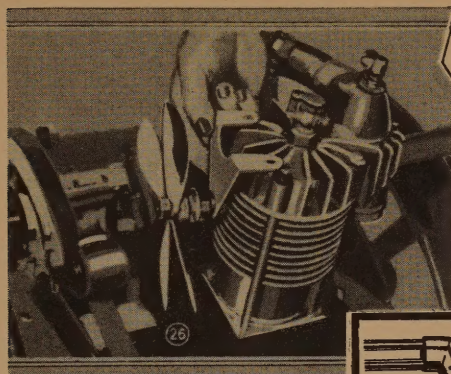
able. The motor shown here is a single-cylinder motorcycle engine, capable of developing 3 hp. and a peak speed of about 3,500 r.p.m. Thus, running at half speed, this outfit would develop a good tractor speed of 2 1/2 miles per hour, the gearing being as shown in Fig. 19, and based on a 2 1/4-in. pulley at the motor end. Inasmuch as a motorcycle engine will be the choice of the average builder, a detail on how the pulley is adapted is given in Figs. 20 and 21. The original sprocket is removed and a 1-in. length of 1 1/2-in. pipe nipple is brazed into place. This is turned into a length of 1 1/2-in. pipe coupling, which, with the flanges shown in Fig. 20, make the actual pulley. The V-groove on the heavier flange makes the take-off to the air-circulating fan. In mounting the completed pulley, the original shaft key and nut are used as before, as shown in Fig. 21. Fig. 22 details how the



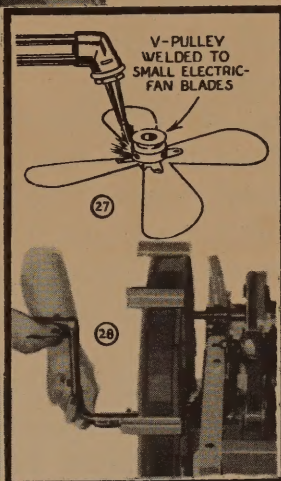
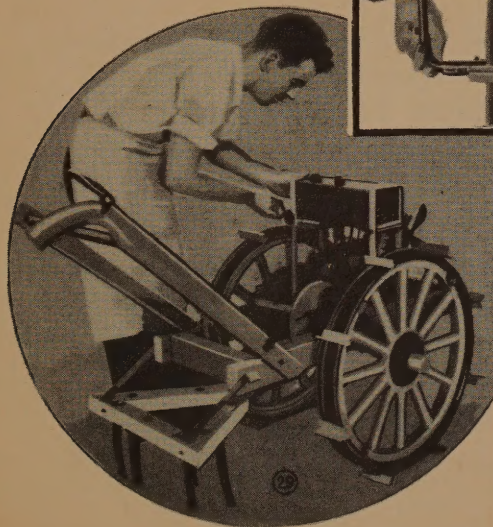
made from automobile gas-control fittings, and then up the plow handle to another lever taken from an automobile emergency brake. In use, a spring holds the idler clear, motive power being obtained by depressing the control lever so that the idler is forced



against the belt. Notice, in Fig. 27, that the circulating fan is simply a small electric fan coupled with a small V-pulley. The whole unit is held with a suitable bracket from No. 16-gauge metal stock clamped to the top of the cylinder, as in Fig. 26. Starting is done by inserting the crank between the spokes of the wheel to engage the pin inside the motor pulley, as shown in Fig. 28. The gas and oil supply is carried in a small tank mounted with flat-iron stock, as



shown in Fig. 29. This can be made from galvanized stock to fit, or any small tank can be adapted for the purpose. Don't forget the paint. Of course, it doesn't make the thing run any better,



but it does stamp your work as well done.

In constructing this garden tractor, it is advisable to follow the instructions in all details, using the various parts that have been recommended. Where these are not available, other similar parts may have to be substituted and, in this case, it may be necessary to deviate from the exact mounting arrangement shown.

MATERIAL LIST

1. 10 ft., 1 3/8 by 3-in. Wh. Oak, for frame
2. One Axle (Ford rear)
3. Four Spring-Shackle Brackets
4. Two Wheels (Ford rear)
5. 7 ft., 1-in. Angle Iron
6. 1/4-in. Boiler Plate, 15 in. square
7. Ring Gear (Ford)
8. One Rear Hub (Ford)
9. One 8-in. Brake Drum (Ford)
10. One Driveshaft (Ford)
11. Three Spring Leaves (1 1/2 in. wide)
12. Strap Stock for Cultivator
13. 25 in., 1-in. T-Stock
14. 1 1/2-in. Pipe Coupling
15. 1 1/2-in. Pipe Nipple
16. 1/8-in. Pipe Nipple
17. Two 1/8-in. Locknuts
18. 5 ft., 1 1/2 by 2-in., Oak
19. One Fan Pulley (Ford) with Bracket
20. Small Electric Fan
21. Small V-Pulley
22. Two Gas Control Levers (from any car)
23. 5 ft., 3/8-in. Rod
24. Emergency Brake Handle (from any car)
25. Two Plow Handles
26. One Bendix Gear (Ford)
27. Motor, Motor Mount, Fastenings and Small Items to Complete Assembly

"A Friend in Need"

[The following letter was received from one of our readers, Mr. Alfred J. Dieter, of Buffalo, N. Y.]

I want to compliment your magazine on having things that men who like to make things want.

As an instance, I have lately become interested in miniature photography, and naturally needed an enlarger to print fair size pictures from the small size negatives, as well as larger ones I have accumulated for a number of years.

I soon saw that to purchase an enlarger would be way beyond what I could conveniently spend, so proceeded to look through all the photographic magazines for constructional details . . . without result.

While the magazines spoke of enlargers in a general sort of way, I could not find anything that gave the constructional details.

The thought occurred to me to ask Popular Mechanics if they had anything to offer, and I received a prompt reply to refer to the January 1939 issue, which gave me just what I wanted.

This is not the first time I turned to Popular Mechanics . . . my old standby . . . for help. When I wanted a 14 foot V-bottom boat, Popular Mechanics gave me constructional details for building the "Skeedadle, which I built and is one of the slickest fishing boats in the fishing sections of Lake Erie, around the Low Banks, Ontario section. Next came a tractor-cradle for launching and beaching the boat, which your magazine gave full working details.

A fine door-bell chime came next, which I built as Popular Mechanics instructed, and I've heard several call it a masterpiece.

Yes, Popular Mechanics is "a friend in need" for the man who likes to build things, and I take this opportunity to thank you for the fine things you are doing for us.

FREE Knowing you will find Popular Mechanics as good a friend as Mr. Dieters has, we will gladly mail you a sample copy if you will send a postcard to Popular Mechanics Magazine, Dept. 508, 200 East Ontario St., Chicago, Ill.